

## ABSTRACT

A bioreactor for three-dimensional culture of liver cells is disclosed. The device is characterized by the use of textile vasculatures. A model and method for optimizing vasculature parameters is also disclosed. Liver acinar structure and physiological parameters are mimicked  
5 by sandwiching cells in the space between the two innermost woven textile hollow fibers, and creating radial flow of media from an outer compartment, through the cell mass compartment, and to an inner compartment. The theoretical optimum hydraulic permeability for the two innermost semi-permeable membranes is determined based on physiological hepatic sinusoidal blood flow and pressures. Experimental studies using a flow rate and pressure monitoring  
10 systems in conjunction with phase-contrast velocity-encoded MRI confirm theoretical results. Novel woven vascular tubes with optimum hydraulic permeability are disclosed for culturing hepatocytes in the multi-coaxial bioreactor.